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METHANOL SAFE HANDLING AND STORAGE

Distributed Generation Code Workshop

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Presentation Overview

- What is Methanol?
- Methanol End Uses
- Benefits of Methanol
- Methanol Codes and Standards
- Fire, Health, and Environmental Safety
- Methanol Storage and Handling
- Tote Specifications
- Customer Operational Guidelines
- Code Guidelines for Methanol Totes
- Installation Inspection Checklists
- Feedback

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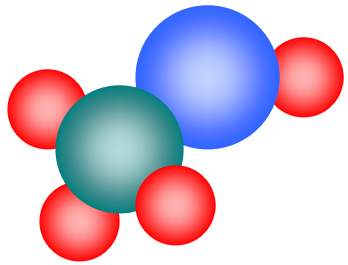
What is Methanol?



- **Methanol - What is it?**
  - A simple molecule - CH_3OH
  - A colorless liquid at ambient conditions
  - Occurs naturally in the environment
  - Biodegrades quickly in all environmental media
- **Methanol - Where does it come from?**
  - Typically made from natural gas
  - Production from biomass has also been demonstrated

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Methanol End Uses

- Windshield Washer Fluids
- Fondue Fuel
- Wastewater Treatment
- Automotive Fuels & Additives
- Solvents
- Paints and Varnishes
- Gasoline De-Icer
- Used to make other chemicals such as MTBE, Formaldehyde, Acetic Acid, etc...
- Many Others

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Benefits of Methanol as a Fuel for Fuel Cells

- High purity fuel
- Easier to reform than “traditional” fuels
- Liquid fuel
- Widely available fuel
- Cost competitive with other fuels
- Significant greenhouse gas benefits

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Methanol Codes and Standards

- **Methanol is already a widely distributed product.**
- **Methanol can be stored and distributed in much the same way as gasoline.**
- **Methanol transport and storage is regulated by <u>existing</u> codes and standards. For example,**
  - UFC 1997 Article 79
  - IFC 2000 Chapter 34
  - NFPA 30
  - CFR 49 / TDG Regulations

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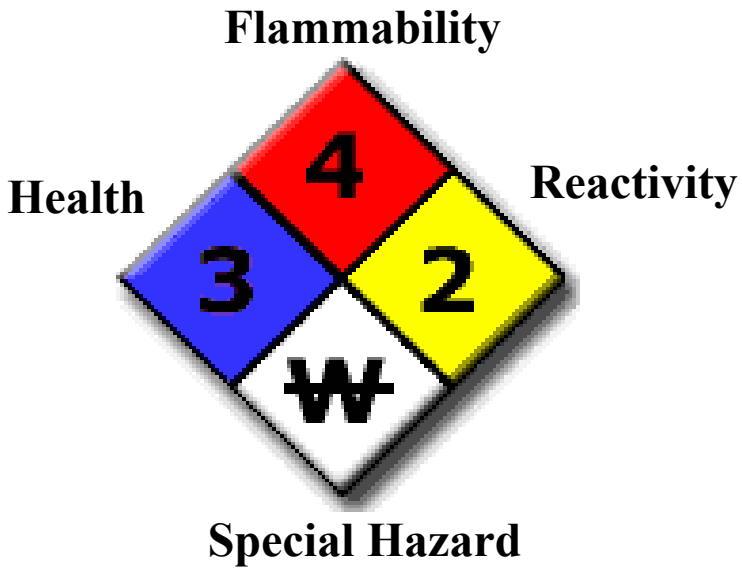
Fire Safety
NFPA 704 Hazard Identification Ratings

- **Rating system for flammable materials**
  - Health,flammability, reactivity, special hazards

Example Hazard Diamond



- **Methanol ratings**
  - Flammability = 3
  - Health = 1
  - Reactivity = 0
  - No special hazards

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Fire Safety
NFPA 704 Hazard Identification Ratings

Health Hazard	
4	Very short exposure could cause death or serious residual injury even though prompt medical attention was given.
3	Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.
2	Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.
1	Exposure could cause irritation but only minor residual injury even if no treatment is given.
0	Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

Methanol NFPA Rating : 1

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Fire Safety

NFPA 704 Hazard Identification Ratings

Reactivity	
4	Readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Capable of detonation or explosive reaction, but requires a strong initiating source or must be heated under confinement before initiation, or reacts explosively with water.
2	Normally unstable and readily undergoes violent decomposition but does not detonate. Also: may react violently with water or may form potentially explosive mixtures with water.
1	Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.
0	Normally stable, even under fire exposure conditions, and is not reactive with water.

Methanol NFPA Rating : 0

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Fire Safety
NFPA 704 Hazard Identification Ratings

Special Hazards	
OX	This denotes an oxidizer, a chemical which can greatly increase the rate of combustion/fire.
ACID	This indicates that the material is an acid, a corrosive material that has a pH lower than 7.0.
ALK	This denotes an alkaline material, also called a base. These caustic materials have a pH greater than 7.0.
COR	This denotes a material that is corrosive (it could be either an acid or a base).

Methanol Has No Special Hazards

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Fire Safety
NFPA 704 Hazard Identification Ratings

Flammability	
4	Will rapidly or completely vaporize at normal pressure and temperatures, or is readily dispersed in air and will burn readily.
3	Liquids and solids that can be ignited under almost all ambient conditions.
2	Must be moderately heated or exposed to relatively high temperature before ignition can occur.
1	Must be preheated before ignition can occur.
0	Materials will not burn.

Methanol NFPA Rating : 3

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Fire Safety
Comparison with Traditional Fuels

- **Methanol Classification**
  - Class 1B Flammable Liquid (NFPA)
  - Class 3 Flammable Liquid (DOT/TDG)
- **Gasoline Classification**
  - Class 1B Flammable Liquid (NFPA)
  - Class 3 Flammable Liquid (DOT/TDG)
- **Propane Classification**
  - Flammable Gas (NFPA)
  - Class 2.1 Flammable Gas (DOT/TDG)

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Fire Safety
Comparison with Traditional Fuels

	Methanol	Gasoline	Propane
Flash Point (Deg F)	54	-45	-156
Boiling Point (Deg F)	148	100 to 400	-42
Reid Vapor Pressure (psi)	4.6	7 to 15	7.8
Lower Flammability Limit (%)	6.0	1.3	2.3
Higher Flammability Limit (%)	36	7.1	9.5
Autoignition Temperature (Deg F)	878	824	842
Lower Heating Value (BTU/gal)	56,800	115,000	93,500
Vapor Density (relative to air)	1.11	5 to 6	2 to 5

Sources : NFPA 325 1994 Edition, Guide to Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids.

Sax's Dangerous Properties of Industrial Materials, 8th Editions.

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Fire Safety
Fire Fighting Information

- Flame Visibility

EXTINGUISHING FIRES

- Dry Chemical Powder
- AFFF (R) Alcohol Resistant Foam
- Water

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Health Safety
Methanol Toxicity Safety Rules

- **WHMIS**
  - D1A Poison
- **Exposure Limits**
  - 8-Hour : 200 ppm
  - 15-Minute : 250 ppm
- **SAFETY RULES**
  - Do not drink methanol
  - Avoid skin contact
  - Avoid prolonged or repeated breathing of vapors
  - Seek proper medical attention

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Environmental Safety

- **Environmentally Friendly Fuel**
  - Methanol is considered to be one of the the most biodegradable substances on earth
  - Show soil and groundwater video 
- **Spill Clean Up**
- **Waste Disposal**

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Methanol Storage and Handling

Transition of methanol storage and handling systems

345 Gallon Totes

Temporary installation for short term fuel cell field trials.

On-Site Storage Tank

Permanent installations for commercial fuel cell products.

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Tote Specifications

345-gal SS JumboBin Tote

- **Dimensions**
  - 42”X48”X48”
- **Weight**
  - Empty = 510 lbs
  - Full = 2,800 lbs
- **Material of Construction**
  - 304 Stainless Steel
- **Compliant With:**
  - CFR 49
  - NFPA 30 - 2000
  - IFC 2000
  - UFC 2000

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Customer Operational Guidelines

- **Guidelines:**
  - Developed for methanol tote customers.
  - General guide for the safe use and operation of a tote and the safe storage and handling of methanol.
- **Guidelines are <u>not</u> a replacement for federal, state, and local laws and regulations.**
- **Customer is advised to approach local authority for permitting the installation and use of methanol storage system.**

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Customer Operational Guidelines

- Tote specifications
- Safety and handling of tote and methanol
- Tote delivery and receiving
- Siting the fuel tote
- Site security
- Safety equipment and signage
- Installation and operation of a tote
- Preparing tote for pick-up
- Methanol health and safety information

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Customer Operational Guidelines

- **Guidelines based on:**
  - UFC Article 79
  - NFPA 30
  - CFR 49 / TDG Regulations
  - OSHA
  - HAZOP Analysis

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Code Guidelines for Methanol Totes

- **Developed by Gage-Babcock & Associates, Ltd.**
- **Information on how tote installation complies with appropriate codes.**
- **Includes:**
  - Plans
  - Tote construction
  - Venting
  - Location
  - Spill Control
  - Storage Area
  - etc….

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Code Guidelines for Methanol Totes
Example of Guideline Section

Location

The totes are classified as *Atmospheric Pressure Tanks* and are required to be located:

- at least 10 ft from a property line that can be built upon,
- at least 5 ft from the closest edge of a public way or a building on the same property.

If there is not a fire department or fire brigade that can respond to a fire within a reasonable time, these distances are required to be doubled.

Code References

NFPA 30 - 2000

2.3.2.1.1 and
Tables 2.3.2.1.1(a) & (b)

IFC 2000

3402.9.5.1.1

NFPA 30 - 1996

2-3.2.1 and
Tables 2-1 & 2-6

UFC 1997

7902.2.2.2 and
Tables 7902.2A & F

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Installation Inspection Checklist

- **Developed by Gage-Babcock & Associates, Ltd.**
- **Methanol tote inspection checklist for:**
  - NFPA 30-2000
  - IFC 2000
  - UFC 1997
- **Available December 1, 2002**

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Feedback

- **Methanex is interested in feedback on:**
  - Customer operational guidelines
  - Code guidelines for methanol totes
  - Methanol tote inspection checklists
  - Ways to make installation and permitting of methanol tanks easier, safer, and quicker